UMEÅ UNIVERSITY

Master thesis projects in the space physics group

Space plasma physics is the physics of naturally occurring plasmas (ionized gases) in the part of space that can be observed in-situ (in place) by spacecraft. This means that we study plasmas in the solar system, for example around planets and comets as well as in the solar wind, which is a supersonic plasma blowing from the sun through the solar system. This solar wind interacts with the solar system objects, and creates magnetospheres around objects with intrinsic magnetic fields and/or atmospheres. A magnetosphere is the region around a magnetized planet where the planet's intrinsic magnetic field dominates. The first interaction of an object with the solar wind is at the bow shock, which is formed to decelerate the solar wind so that it can pass around the magnetosphere and behind it.

The solar wind has a great influence on what happens in the magnetosphere of a planet or a comet. For example, interactions with the solar wind can cause atmospheric loss from planets such as Earth, Venus, and Mars. Moreover, energy from the solar wind can enter into the magnetosphere of the objects and cause many effects. For example, geomagnetic storms and auroras (northern lights) are a result of these solar-terrestrial interactions. After solar eruptions such as coronal mass ejections, the auroras can be extra strong. Geomagnetic storms also have an important impact on our infrastructure due to geomagnetically induced currents. The effect of geospace on our infrastructures is commonly referred to as "Space Weather".

We have the possibility to offer master thesis projects in the area of our expertise. **Come and discuss with us if you are interested in a project!**

We work both with analyzing data from ESA and NASA spacecraft as well as with numerical simulations. We presently work on topics concerning for example:

- What are the behavior of the plasma flows in Earth's magnetotail (nightside magnetosphere), and how do the flows affect the transport of energy in the magnetosphere, for example coupling to the aurora?
- How does the orientation of the magnetotail vary with changes in the solar wind magnetic field?
- How does the magnetosphere and bow shock develop around a comet as its outgassing changes closer to the sun?
- How can high speed jet flows from the solar wind penetrate through the bow shock and collide with the magnetosphere of Earth, and what are the effects that can be caused in the low altitude ionosphere?

The group consists of Maria Hamrin (group leader), Herbert Gunell (prof.), Hermann Opgenoorth (prof.), Timo Pitkänen (researcher), Patrik Norqvist (lecturer), Oleksandr Goncharov (postdoc), Siung Chong (postdoc), and Alexandre De Spiegeleer (PhD student).